OPERATION AND SERVICE MANUAL

MODEL 312D STANDBY POWER SUPPLY

G-65008

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TRACOR 6500 TRACOR LANE, AUSTIN, TEXAS 78721

Model 312D Standby Power Supply
Operation and Service Manual Addendum

G-65008

A-1 Purpose of addendum:

This addendum is to clarify paragraph 2-14 on page 2-1.

A-2 Additional information on using Chassis-Trak CTD-118 slides.

1. TRACOR part # G-35218 must be added to side rails before slides CTD-118 can be used.

A-3 Change last sentence of paragraph 2-14 page 2-1 to read:

Holes in the side panel will accept adapter G-35218, which must be used when mounting CTD-118 Chassis-Trak slides. This adapter is an optional item.

WARRANTY

TRACOR, Inc. warrants each instrument it manufactures to be free from defects in material and workmanship. The obligation under this warranty is limited to repairing or replacing any instrument or part thereof that shall be returned to us by the original purchaser, transportation charges prepaid, when upon examination it is disclosed to our satisfaction to be defective. This warranty is effective for one year after delivery to the original purchaser. If the fault has been caused by misuse or abnormal conditions of operation, repair will be made at cost. In this case, an estimate will be submitted before work is started.

If any fault develops, notify TRACOR, Inc. and give full details, including model and serial numbers. You will then be notified as to the disposition of the defective instrument.

TRACOR, INC.
6500 Tracor Lane
Austin, Texas 78721
AC 512 / 926-2800
ATTN: PRODUCT SERVICE

TRACOR

A6-106-76A

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SECTION I
GENERAL DESCRIPTION

1-1. **SCOPE OF SECTION.**

1-2. This section describes the purpose and physical characteristics of the supply and provides a brief description of operating controls and indicating lamps.

1-3. **PURPOSE OF EQUIPMENT.**

1-4. The supply provides direct current power, with battery backup, for Rubidium Frequency Standard Model 304D or VLF Receiver Model 599K in the event of ac power failure. The supply may be used with other equipment having similar power requirements.

1-5. **DESCRIPTION OF EQUIPMENT.**

1-6. The supply (figure 1-1) is 5-1/4 inches high, 16-1/2 inches deep, and 19 inches wide for standard rack mounting. It weighs 19 pounds without the battery or 54 pounds with the battery.

1-7. With 90 to 130 volts, 50 to 400 Hz, single phase input voltage, the supply provides plus or minus 24 volts dc. The supply is equipped either with or without an internal battery. The fast charge timer charges the battery in 2 hours per ampere hour of battery use. Refer to table 1-1 for a functional description of the supply controls and indicators.

1-8. Standby power is derived from an internal battery whose charge is maintained by the supply. Space is provided for an 11 ampere-hour battery of sealed nickel-cadmium cells. This is sufficient to operate the Rubidium Frequency Standard Model 304D for eight hours or three VLF Receivers Model 599K for four hours. When ac power is lost, changeover to standby power is transient-free. For protection against possible battery damage an undervoltage control disconnects the battery from the load should the battery voltage fall below a predetermined value.

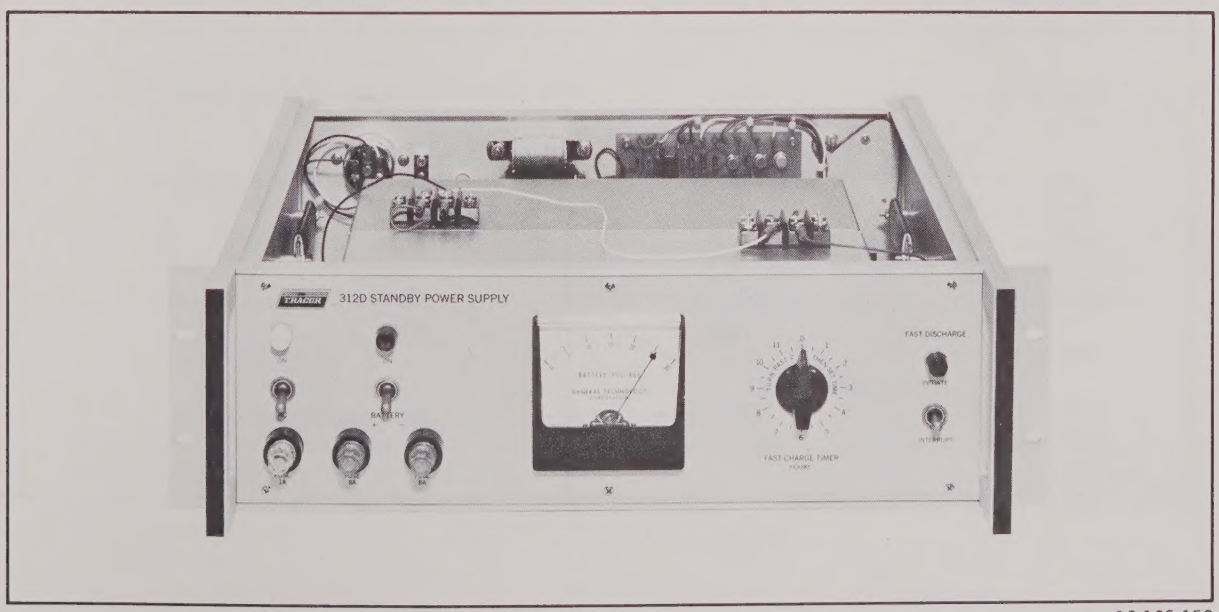

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Figure 1-1. Standby Power Supply Model 312D (Top Cover Removed)

TABLE 1-1. STANDBY POWER SUPPLY CONTROLS AND INDICATORS.

NAME	REFERENCE DESIGNATION	FUNCTION
AC switch	S1	Applies 115 volts ac to rectifier circuit which charges battery.
AC lamp	DS1	Indicates 115 volts ac is applied to rectifier circuit.
1 AMP FUSE	F1	Protects rectifier circuit from surge currents.
BATTERY switch	S2	Applies battery voltage to output connector.
BATTERY lamp	DS3	Indicates S2 is in proper position and that both battery fuses are not open.
+BATTERY 3 AMP FUSE and -BATTERY 3 AMP FUSE	F2 and F3	Protect dc outputs.
Battery Voltage meter	M1	Indicates dc voltage across battery.
FAST CHARGE TIMER switch	CMC1	Activates fast charge circuitry.
INITIATE/ INTERRUPT switch	S3	Connects battery to internal load.
FAST DISCHARGE lamp	DS2	Indicates circuitry is in fast discharge mode.

SECTION II
INSTALLATION

2-1. **SCOPE OF SECTION.**

2-2. This section provides instructions for installation of the supply.

2-3. **UNPACKING AND INSPECTION.**

2-4. Carefully unpack and examine the supply for possible damage during shipment. Special attention should be given to areas where the outside shipping package may have been damaged.

2-5. **BATTERY INSTALLATION.**

2-6. The battery packs for the supply are shipped separately to prevent possible damage to the supply in the event of electrolyte leakage during shipment. Install the battery packs as follows:

a. Remove top and bottom covers from supply. Turn supply upside down.
b. Place first pack in supply with terminal block down on left side align with mounting holes nearest front panel.
c. Place second pack to rear of first pack with terminal block down on right side.
d. Mount pack to supply with screws and washers supplied.
e. Turn supply right side up and connect red wire, black wire, and jumpers as shown in figure 2-1.

CAUTION

When lowering packs into supply, do not allow terminal blocks to contact metal parts. Supply may be damaged if battery pack is connected with improper polarity.

2-7. **BATTERY REMOVAL.**

2-8. To remove battery pack perform the reverse of the steps in paragraph 2-6.

2-9. **POWER CONNECTIONS.**

2-10. Connect ac power cord into a NEMA approved three-prong receptacle. If a two-prong adapter is used, the external adapter wire to ground shall be grounded.

2-11. **DC OUTPUT CONNECTIONS.**

2-12. Female connector J1 on the rear panel provides the dc voltage output pins. A male connector, P1, is supplied to make proper connections to the external equipment. Pin A provides +24 volts dc. For (+) or (−) 24 volts dc output, use pins A (+) and C (−). Either pin A (+) or C (−) may be grounded; they are isolated from chassis by 1 megohm. Pin B is not used for (+) or (−) 24 volts dc operation, or 5 amp operation. Diode CR8 is an optional feature that allows parallel operation of two supplies (see figure 7-1).

CAUTION

As a safety measure, set the front panel DC ON switch to the off position during connection and removal of the dc power output cable.

2-13. **RACK MOUNTING.**

2-14. When the supply will be rack mounted instead of being used on the bench, chassis slides should be used. Holes in the side panels will accept Chassis-Trak type CTD-118 slides.

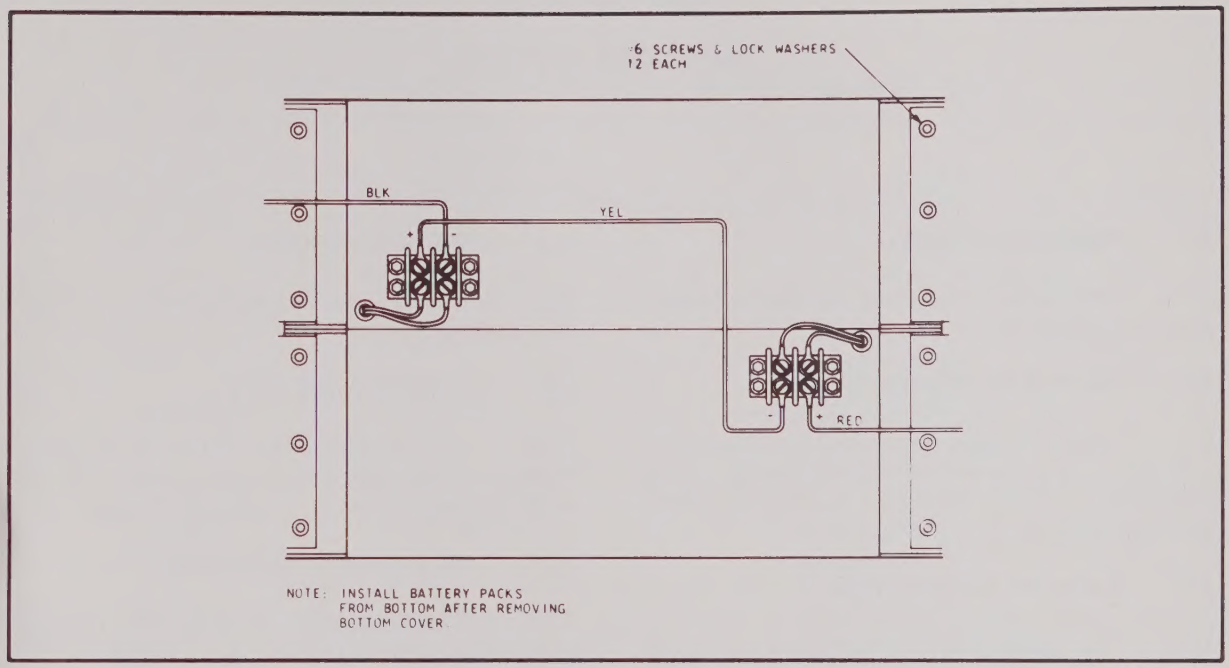

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Figure 2-1. Battery Pack Installation

SECTION III
OPERATION

3-1. **SCOPE OF SECTION.**

3-2. This section provides instructions for operation of the supply.

3-3. **EQUIPMENT TURN ON.**

3-4. Turn on the supply as follows:

a. Connect supply to ac power.
b. Connect supply to primary equipment through J1.
c. Set FAST CHARGE TIMER to zero.
d. Set front panel BATTERY and AC switches to ON position. Lamps shall light.

3-5. **OPERATION.**

3-6. Under normal conditions the dc power supply within the primary equipment provides the required dc voltage. If ac power is lost completely, the supply provides dc power from the battery. If ac power is low, the supply provides a portion of the required dc power. To insure a state of readiness, the front panel AC and DC switches should remain in the ON position. When the supply and primary equipment are connected, changeover to standby power is automatic. When standby power is drawn from a fully charged battery, the battery voltage will decrease, rapidly at first, then reach a plateau, and finally decrease again. The amount of initial drop and the length and voltage level of the plateau will depend on the load.

3-7. **BATTERY RECHARGE.**

3-8. The supply has two different operating cycles for battery charging. When ac power is applied and the supply is turned on, a trickle charging current of approximately 0.1 amperes is continuously applied to the battery. At this charge rate, a completely discharged battery would require approximately one week for recharging. The supply is equipped with a fast charge capability to accelerate the charge cycle. This charge cycle applies a one ampere charging current to the battery for the amount of time determined by the front panel timer.

3-9. TRICKLE CHARGE OPERATION.

3-10. The supply automatically supplies dc power from the battery whenever ac power is interrupted. When ac power is reapplied to the supply, the battery will be automatically recharged at the trickle charge rate. When the battery is fully charged, the front panel meter should indicate approximately 28 volts dc. This continuous trickle charge will not damage the battery cells in any way, but after a period of several months the charging current will passivate the cell plates, reducing the battery capacity. To correct this condition, perform a discharge-charge cycle in accordance with paragraph 5-6.

3-11. FAST CHARGE OPERATION.

3-12. The battery can rapidly be restored to full capacity after use by activating the fast charge cycle. This is accomplished by turning the FAST CHARGE TIMER clockwise to the required number of hours to fully recharge the battery. The battery should be recharged 1.5 hours for each ampere-hour of use during standby operation. If the amount of battery discharge is not known, the fast charge time can be estimated. A fully discharged battery requires from 12 to 14 hours for recharge at the fast rate.

CAUTION

Do not charge the battery at the fast rate for more than 14 hours for each time the battery is used. This can reduce the life of the battery.

SECTION IV
THEORY OF OPERATION

4-1. **SCOPE OF SECTION.**

4-2. This section provides a general description of the operation of the standby power supply and detailed analysis of the individual circuits.

4-3. **FUNCTIONAL ANALYSIS.**

4-4. The supply can be divided into three main operational sections; rectifying and current limiting, battery charging and discharging, and battery and undervoltage protection sections. Refer to figure 4-1 for a functional block diagram and to figure 7-1 for a schematic diagram of the supply.

4-5. RECTIFYING AND CURRENT LIMITING SECTION.

4-6. When the AC switch is set to ON position, full wave rectified dc voltage is obtained from transformer T1, diodes CR1 and CR2, and capacitor C1. Current limiting occurs at approximately 1.1 amperes on fast charge and 0.1 amperes on slow charge.

4-7. BATTERY CHARGING AND DISCHARGING SECTION.

4-8. The slow charge circuit is always connected to the battery and maintains a 0.1 ampere charge current on the battery at all times. The fast charge circuit is activated by FAST CHARGE TIMER. The duration of fast charge is adjustable from 0.25 to 12 hours. Fast discharge is initiated by momentarily setting INITIATE/INTERRUPT switch S3 to INITIATE position. A fast discharge current of approximately 2 amperes flows and FAST DISCHARGE lamp DS2 will be on during the fast discharge cycle.

4-9. BATTERY AND UNDERVOLTAGE PROTECTION SECTION.

4-10. The battery consists of 20 sealed nickel-cadmium cells, with a total nominal voltage of 25 volts. At lower voltages, one or more of the cells may reverse its polarity and draw a charging current from the other cells. The current drawn may be large enough to damage the reversed cells. A rupture type safety seal on each cell prevents catastrophic damage. An undervoltage protection circuit disconnects the battery from the load when the total battery voltages drop below approximately 20 volts dc.

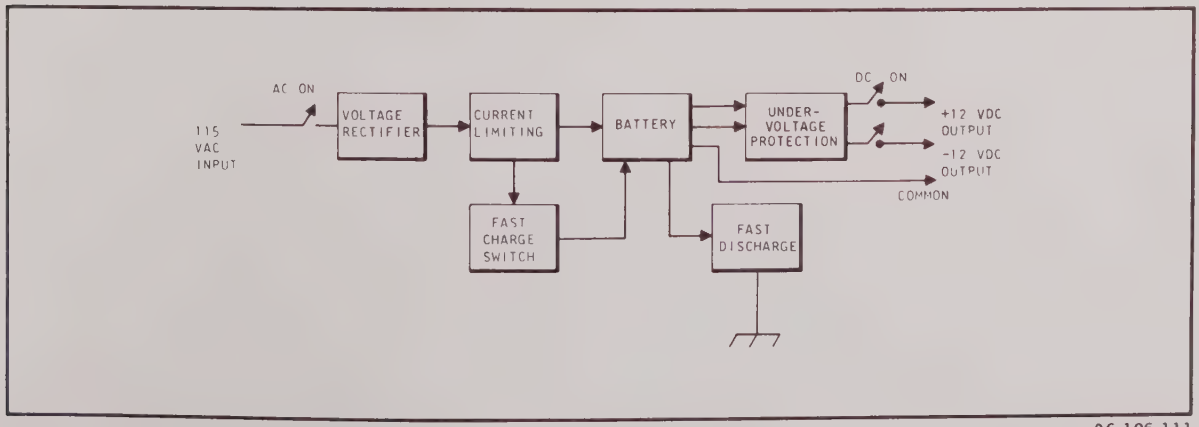


Figure 4-1. Supply Functional Block Diagram

4-11. DETAILED THEORY OF OPERATION.

4-12. The standby power supply contains a voltage rectifier, a current limiter, a battery charger, a battery discharger, and an undervoltage protection circuit. Refer to figure 7-1 for a schematic diagram of the supply.

4-13. VOLTAGE RECTIFIER.

4-14. The voltage rectifier converts 115 volts ac input power, coupled through centertapped power transformer T1, to dc voltage. The full wave rectifier consists of diodes CR1 and CR2. Capacitor C1 reduces ripple. Diode CR3 prevents excessive reverse base-emitter voltage on transistors Q1 and Q2 when the battery voltage exceeds the voltage on capacitor C1. Resistor R10 isolates pins A and C of J1 from the chassis.

4-15. CURRENT LIMITER.

4-16. On slow charge, current limiting is obtained with resistor R4 and the base-emitter potential of transistor Q3. When the voltage across R4 exceeds 0.6 volt, transistor Q3 will conduct and current flow through Q1 and Q2 will be reduced until a balance is obtained.

4-17. BATTERY CHARGER.

4-18. Current is supplied to the battery when AC switch S1 is in ON position. Transistors Q1, Q2, and Q3, and resistor R4 regulate the slow charge current at 0.1 ampere. When FAST CHARGE TIMER switch is activated, resistors R2 and R3 are in parallel with R4 which regulate the fast charge current at 1.1 amperes.

4-19. FAST BATTERY DISCHARGER.

4-20. Fast discharge is initiated by momentarily setting the INITIATE/INTERRUPT switch S3 to INITIATE position. This causes transistor Q5 to conduct. Conduction of Q5 causes relay K2 to energize. When K2 energizes, a current of approximately 2 amperes flows through internal load resistors R8 and R9 and K2A contacts. Contacts K2B open the ac input power so that the charging circuit is not active during the fast discharge cycle. When K2 deenergizes, diode CR6 protects transistor Q5 from inductive kickback of the coil relay K2. When the INITIATE/INTERRUPT switch S3 is set to INTERRUPT position, transistor Q5 will not conduct and the fast discharge is stopped. When the undervoltage protection circuit activates, relay contacts K1A open and the fast discharge is stopped.

4-21. UNDERVOLTAGE PROTECTION CIRCUIT.

4-22. Relay K1 is energized because of current flow in transistor Q4 which provides a ground for relay K1. When the battery voltage drops below 20 volts dc, Zener diode CR4 stops conducting, transistor Q4 stops conducting, and relay K1 deenergizes. When relay K1 deenergizes, relay contacts K1A and K1B open and power is not delivered to the load. Diode CR5 protects transistor Q4 from the inductive kickback of the coil of relay K1.

SECTION V
MAINTENANCE

5-1. **SCOPE OF SECTION.**

5-2. This section provides instructions for troubleshooting and maintaining the standby power supply.

5-3. **TROUBLESHOOTING.**

5-4. Because of the simplicity of the supply, troubleshooting procedures are not required. If necessary, refer to the schematic diagram (figure 7-1) to aid in troubleshooting if the supply does not operate properly.

5-5. **MAINTENANCE.**

5-6. At approximately a three month interval, the battery should be completely discharged and recharged to insure that the battery maintains its full capacity. To accomplish this, place INITIATE/INTERRUPT switch to INITIATE position and allow battery to discharge until the FAST DISCHARGE lamp goes out, indicating the battery is fully discharged. This will take 4 to 6 hours. When the FAST DISCHARGE lamp goes out, set the FAST CHARGE TIMER to 12 hours and allow battery to fully charge. If ac power is lost during fast discharge cycle, relay K1 is deenergized, the discharge cycle is automatically interrupted, and the FAST DISCHARGE lamp goes out. When ac power is restored, manually start fast discharge cycle again. If the fast discharge cycle must be stopped, set the INITIATE/INTERRUPT switch to INTERRUPT position.

CAUTION

Do not charge the battery at the fast rate for more than 14 hours for each time the battery is used. This can reduce the life of the battery.

SECTION VI
REPLACEABLE PARTS

6-1. **SCOPE OF SECTION.**

6-2. This section provides all necessary information for quick identification of replaceable parts for the standby power supply. The section contains a list of replaceable parts and a numeric list of federal supply codes for manufacturers.

6-3. **LIST OF REPLACEABLE PARTS.**

6-4. A list of replaceable parts for the supply is presented in table 6-1. Information in the table includes the reference designation, part description, TRACOR stock number, federal supply code for manufacturers (FSCM), and manufacturer part number, presented in that order.

6-5. **FEDERAL SUPPLY CODE FOR MANUFACTURERS.**

6-6. A list of manufacturers supplying parts for the supply is provided in table 6-2. Information in the table includes the manufacturer federal supply code number, manufacture's name, and manufactures address, presented in that order. The manufacturers are listed in numerical order by federal supply code number.

6-7. **ORDERING INFORMATION.**

6-8. Address orders or inquiries to either an authorized TRACOR Sales Representative or to:

TRACOR, Inc.
6500 Tracor Lane
Austin, Texas 78721
Attention: Customer Service

6-9. To insure prompt service, orders must include the following information:

a. Name, model, and serial number of the instrument.
b. Reference designation, if applicable.
c. TRACOR stock number, if one is assigned.
d. Full description of the part.

6-10. Item a. is located on the instrument; and items b., c., and d. are found in the List of Replaceable Parts (table 6-1).

6-11. The part numbers shown will change occasionally as manufacturers' items are reevaluated or as improved components become available. The component shipped will be the component used in production at the time the order is received, and will be equivalent to the component it replaces in both dimensions and performance.

Table 6-1. List of Replaceable Parts

REF DES	DESCRIPTION	TRACOR STOCK NO.	FSCM	MFR PART NO.
A1	COMPONENT BD ASSY		91926	G-44647
C1	CAP FXD ELEC 2300 MFD		56289	39D238G050JT4
C2	CAP FXD ELEC 33 MFD		05397	K33J20S
C3	CAP FXD DISC CERAMIC	3319-0502	71590	DD502
F1	FUSE 1 AMP 250 VOLT	3348-9101	71400	AGC 1
F2	FUSE 3 AMP 250 VOLT	3348-9301	71400	AGC 3
F3	FUSE 3 AMP 250 VOLT	3348-9301	71400	AGC 3
J1	RECEPTACLE BOX MTG	3836	71468	CA3102E125-2002-10S
J2	POWER CORD		28480	8120-0050
K1	RELAY DPDT		02289	2B-2A-126
K2	RELAY DPDT		02289	2B-2A-126
M1	METER		16902	1327C (Q6524)
P1	CONNECTOR		71468	CA3102E12S-2002-10P
Q1	TSTR NPN 2N1711	900-1711	03508	2N1711
Q2	TSTR NPN 2N3055	900-3055	01295	2N3055
Q3	TSTR NPN 2N1711	900-1711	03508	2N1711
Q4	TSTR NPN 2N1711	900-1711	03508	2N1711
Q5	TSTR NPN 2N1711	900-1711	03508	2N1711
R1	RES FXD COMP 2.0 K	204-0202	01121	RC07GF202J
R2	RES FXD COMP 1.2 OHM	201-9121	01121	RC20GF1R2G
R3	RES FXD COMP 1.2 OHM	201-9121	01121	RC20GF1R2G
R4	RES FXD COMP 5.1 OHM	201-9511	01121	RC20GF5R1G
R5	RES FXD COMP 510 OHM	204-0511	01121	RC07GF511J
R6	RES FXD COMP 4.3 K	204-0432	01121	RC07GF432J
R7	RES FXD COMP 20 K	204-0203	01121	RC07GF203J
R8	RES FXD WW 250 OHM		44655	RW22V250
R9	RES FXD WW 250 OHM		44655	RW22V250
R10	RES FXD COMP 1.0 M	204-0105	01121	RC07GF105J
R11	RES FXD COMP 15 K	204-0153	01121	RC07GF153J
R12	RES FXD COMP 330 OHM 2W	214-0331	81349	RW59V331
S1	SWITCH DPST		15605	8823K5
S2	SWITCH DPST		15605	8823K5
S3	SWITCH SPDT MOM		15605	8818K5
T1	TRANSFORMER		08779	T56-1
BT1-BT20	BATTERY NI-CAD	3825-0001	88220	P11
CR1	DIODE 1N4999		04713	1N4999
CR2	DIODE 1N4999		04713	1N4999
CR3	DIODE 1N4999		04713	1N4999
CR4	DIODE 1N968A 20V ZENER	801-0968	04713	1N968A
CR5	DIODE 1N914	800-0914	01295	1N914
CR6	DIODE 1N914	800-0914	01295	1N914
CR7	DIODE 1N914	800-0914	01295	1N914
DS1	LAMPHOLDER AND BULB		14889	857-W-A9A-62K
DS2	LAMP BULB INCD 1.12 W	87-0342	08806	327
DS3	LAMP BULB INCD 1.12 W	87-0342	08806	327
XF1	HOLDER FUSE	3488-0011	71400	HKL
XF2	HOLDER FUSE	3488-0014	71400	HKT
XF3	HOLDER FUSE	3488-0014	71400	HKT
CR8	DIODE IN3879		04713	IN3879

Table 6-1 (Continued)

REF DES	DESCRIPTION	TRACOR STOCK NO.	FSCM	MFR PART NO.
CMC1	TIMER OFF TYPE		79919	91054
XDS2	SEE DS1			
XDS2	HOLDER LAMP RED LENS		14889	856S-R-M
XDS3	HOLDER LAMP GRN LENS		14889	856S-G-M

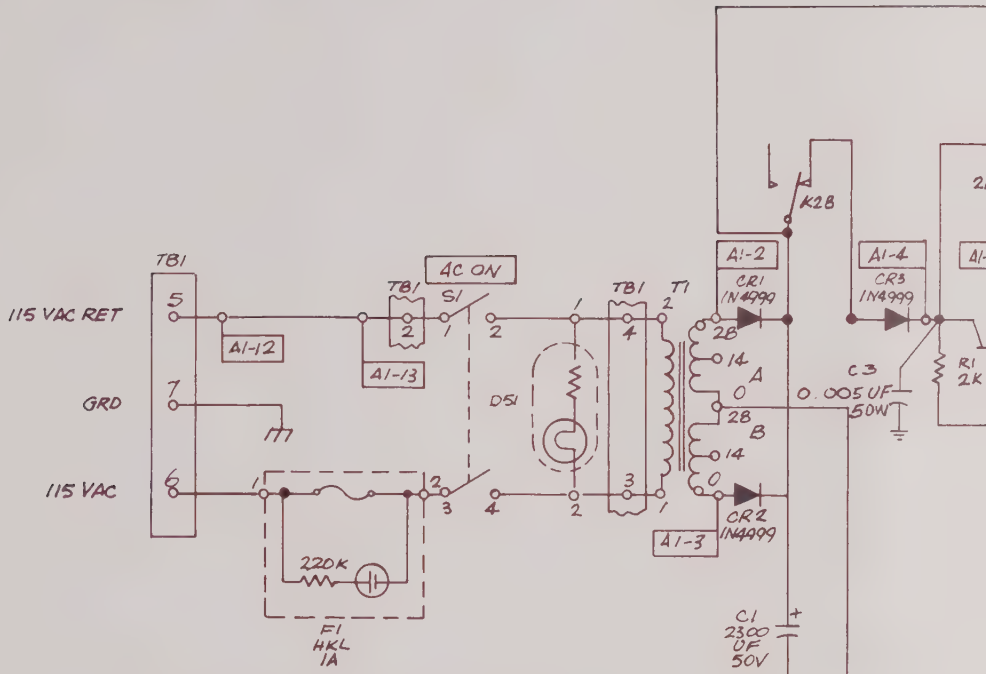
Table 6-2. Federal Supply Code for Manufacturers

CODE NO.	MANUFACTURER	ADDRESS
01121	ALLEN-BRADLEY CO	MILWAUKEE, WIS 53204
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR-COMPONENTS DIV	DALLAS, TEX 75231
02289	HI-G INC	WINDSOR LOCKS, CONN 06096
03508	GECO SEMICONDUCTOR PRODUCTS	SYRACUSE, N Y
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS DIV	PHOENIX, ARIZ 85008
05397	UNION CARBIDE CORP LINDE DIV KEMET DEPT	CLEVELAND, OHIO 45246
08779	SIGNAL TRANSFORMER CO INC	BROOKLYN, N Y 11230
08806	GENERAL ELECTRIC CO MINIATURE LAMP DEPT	CLEVELAND, OHIO 44112
14889	SLOANE MFG CO	SUN VALLEY, CALIF 91352
15605	CUTLER-HAMMER INC	MILWAUKEE, WIS 53233
16902	SIMPSON INSTRUMENTS INC	ESCONIDO, CALIF
28480	HEWLETT-PACKARD CO	PALO ALTO, CALIF 94304
44655	OHMITE MFG CO	SKOKIE, ILL 60076
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS, MASS 01247
71400	BUSSMAN MFG DIV OF MCGRAW-EDISON CO	CHICAGO, ILL 60640
71468	ITT CANNON ELECTRIC INC	LOS ANGELES, CALIF 90031
79919	M H RHODES	HARTFORD, CONN 06101
88220	GOULD-NATIONAL BATTERIES INC ALKALINE BATTERY DIV	ST. PAUL, MINN 55114
19397	TRACOR,INC	AUSTIN, TEX 78721

SECTION VII
DRAWINGS AND DIAGRAMS

7-1. **SCOPE OF SECTION.**

7-2. This section contains the schematic diagram of the supply. The schematic diagram is referenced in Sections IV and V.



NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS, ±5%
2. CMC1 INDICATES MECHANICAL TIMER SWITCH
3. CR8 IS OPTIONAL FOR PARALLEL OPERATION

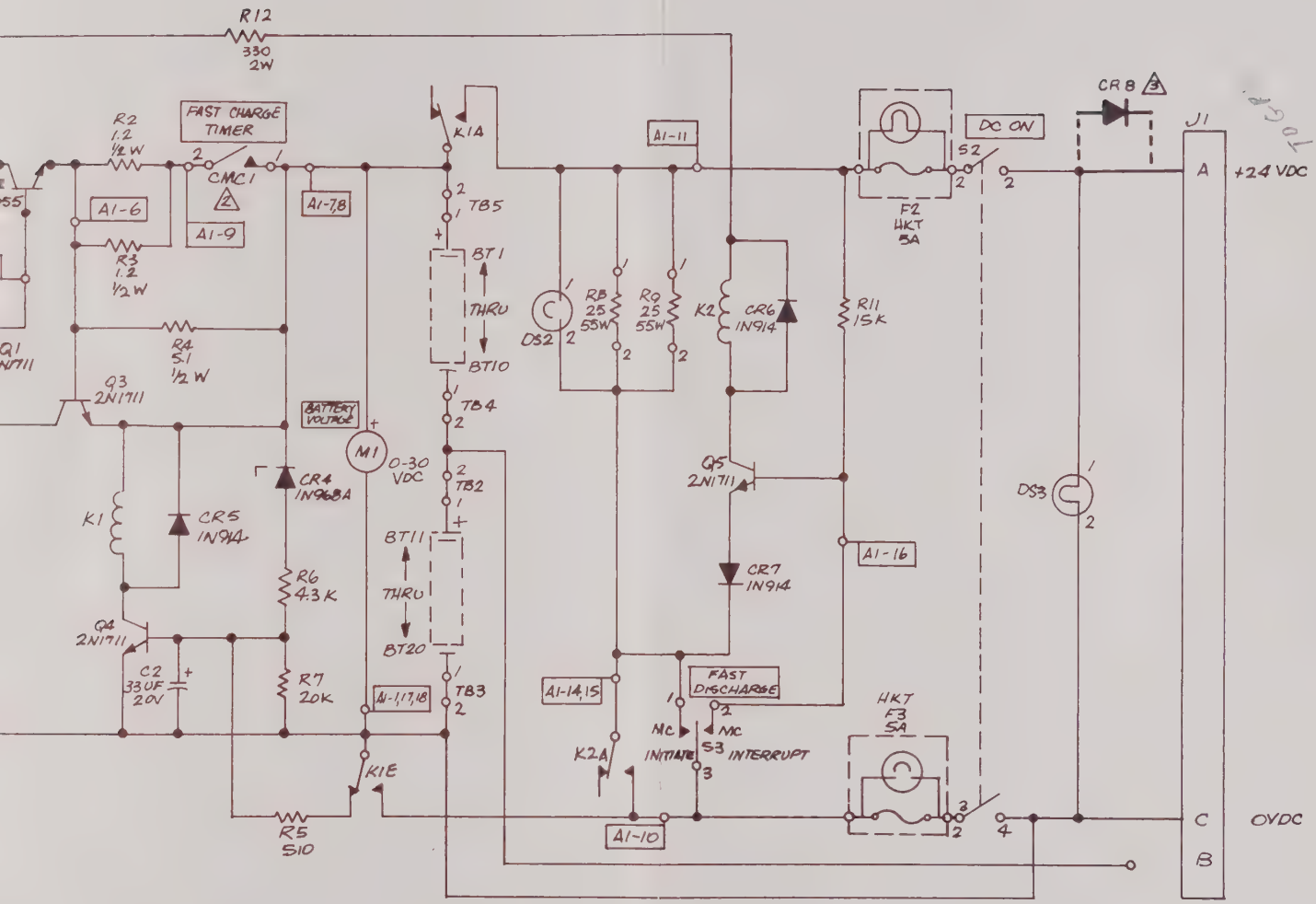


Figure 7-1. Standby Power Supply, Model 312D Schematic Diagram.

READER'S COMMENTS

Your comments regarding this manual will help us improve future editions. Please comment on the usefulness and readability of the manual, suggest additions and deletions, and list specific errors and omissions.

EQUIPMENT NAME _____ MODEL _____

MANUAL NUMBER _____ REV _____

USEFULNESS AND READABILITY

fold fold

SUGGESTED ADDITIONS AND DELETIONS

ERRORS AND OMISSIONS (give page numbers)

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Title or Position _____

Address _____

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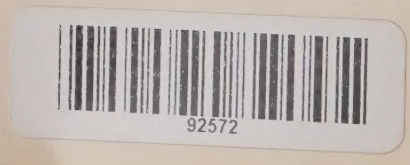
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